

**CLAIMS:**

- 5       **1) Method for introducing additives for exact dosing and homogenous distribution into flowing or fluidised media**, whereas at least one nozzle with a nozzle needle and said nozzle needle is variable activated with high precision by a device, and the amount of additives is dosed in relation to the volume stream of the medium and said nozzle having at least one orifice and the additive is sprayed into the passing medium through said orifice with high pressure and with pulsation, maintaining high kinetic and pulse energy, reaching a penetration into the medium and a homogenous mixture.
- 15       **2) Method for introducing fluid additives into flowing or fluidised media according to claim 1** wherein the additives are introduced and distributed by pulsing injection and at least one operating parameter concerning the additive, of the method as there are temperature, pressure, duration of pulses, frequency of pulses and operating parameter concerning the medium as there are temperature, Pressure, mass flow are variable controlled.
- 20       **3). Method for introducing, for instance injection, atomizing according to claim 1 and 2, of at least one additive in melted, pasties, liquid, dissolved, dispersed, emulated condition, or a combination of this conditions are injected into a medium stream consisting of gas, liquid, melt, paste, plastics, solution, dispersion, emulsion, fluidised bulk material or a combination of this media, wherein the hydro-mechanical blending is carried out by variable pulsing activated injector, and the exact dosing and homogenous mixing is variable controlled by subsequent operation parameters:**

25       **Additives:**

temperature,

pressure,

30       padding-left: 40px;">duration of pulse,

frequency,

**Medium:**

temperature,

pressure,

35       padding-left: 40px;">velocity of stream.

- 4) Method according to claim 1 to 3, wherein additives for instance hardener, dyes, gas producers, softeners are introduced and exactly dosed into plastic melt, metal melt or fluidized material and homogenous mixed.
- 5) Method according to claim 4, wherein the additives in die **casting systems**, optionally are introduced by pulsation into the barrel between two section of the plastisicing cylinder, into the front part of the plastisicing cylinder, before the nozzle, into the melt channel after the non-return-valve, into the Hotrunner system, into a side channel of the melt channel, into side channels of mould sectors.
- 6) Method according to claim 4, wherein the additives in **extrusion systems**, optional are introduced by pulsation into the barrel between to sections of the extruder plastisicing cylinder, into the barrel front chamber, into the melt channel after the extruder nozzle, after a cellular melt pump, into melt channels of the moulds, before the melt distribution system, into the section before the outlet.
- 7) Method according to claim 4, wherein additives in **plastic injection moulding systems** are introduced by pulsation optionally are introduced by pulsation into the barrel between two section of the plastisicing cylinder, into the front part of the plastisicing cylinder, before the nozzle, into the melt channel after the non-return-valve, into the Hotrunner system, into a side channel of the melt channel, into side channels of mould sectors
- 8) Method according to claim 1 to 3, wherein additives in **pelletizing systems** are introduced by pulsation into the mass flow optional between two sections of the pellet extruder, into the front chamber of the extruder, before the nozzle, into the mass flow channel after the extruder, in parts of the channels of the mould.
- 9) Method according to claim 1 to 3, wherein fuel/color are introduced by pulsation in burner/airless spraying-systems are introduced by pulsation into the combustion air stream/spraying stream.
- 10) **Apparatus for introducing of at least one additive** in melted, pasties, plastics, fluid, fluid-gas, solved, dispersed, emulated condition, or in combination of said conditions, into a medium stream consisting of liquid, gas,

melt, paste, plastics, solvents, dispersents, emulgents, granules, pulp, homogenous material and bulk or combination of this media, wherein at least one variable pulsing activated injector reaches into the medium stream and at least one of the following features are designed:

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|----|--|
| 5  | Injector: <ul style="list-style-type: none"> <li>number of nozzles</li> <li>Orifice in the nozzle             <ul style="list-style-type: none"> <li>Number</li> <li>Direction</li> <li>Diameter</li> </ul> </li> </ul>  |
| 10 | <ul style="list-style-type: none"> <li>Variable streamline section (Laval)</li> <li>Valve of the nozzle             <ul style="list-style-type: none"> <li>Needle of the nozzle</li> <li>Seat of the needle                 <ul style="list-style-type: none"> <li>Blind pocket valve,</li> </ul> </li> </ul> </li> </ul>  |
| 15 | <ul style="list-style-type: none"> <li>Valve cone orifice,</li> <li>stream-bending</li> <li>Geometric shape of the needle seat</li> </ul>  |
| 20 | <ul style="list-style-type: none"> <li>Creation of pressure             <ul style="list-style-type: none"> <li>Pump-nozzle (pulsing)</li> <li>Constant pump common rail</li> </ul> </li> <li>Activation of the needle             <ul style="list-style-type: none"> <li>Mechanical</li> <li>Hydraulic                 <ul style="list-style-type: none"> <li>One medium (activation and additive is identical)</li> </ul> </li> </ul> </li> </ul> |
| 25 | <ul style="list-style-type: none"> <li> <ul style="list-style-type: none"> <li>Mechanical valve</li> <li>Electro-magnetically valve</li> <li>Solenoid</li> <li>Piezoelectric</li> </ul> </li> </ul>  |
| 30 | <ul style="list-style-type: none"> <li>Separate medium for hydraulic and additive</li> </ul>   |
| 35 | <ul style="list-style-type: none"> <li>Electrical             <ul style="list-style-type: none"> <li>Solenoid</li> <li>Piezo electric</li> </ul> </li> </ul>   |
|    | Streamline section <ul style="list-style-type: none"> <li>Sectional shape</li> <li>Variable streamline section (Laval)</li> <li>Application of mixing devices</li> </ul>   |

- 11) Apparatus for introduction of additives according to claim 10 for instance hardener, dyes, gas producers, softener into plastic-metal melt, wherein at least one injection nozzle or injector having at least one orifice of 0,08 to 0,2 mm diameter, designed according to the requirement of depth of penetration of the jet into the melt, the direction of the orifices, seat of nozzle as blind pocket valve for homogenous pressure ramping and equal pressure supply to all orifices or as VCO (valve cone orifice) for having small leakage volume and energetic atomizing, because of the narrow slot between nozzle needle and nozzle seat, optional is the activation of the needle by electro hydraulic system as servo valve driven by solenoid, or by piezoelectric actuator, or pneumatic, hydraulic or by extern magnetic field driven nozzle needle, or by linear drive system.
- 12) Apparatus according to claim 10 and 11, for injection moulding systems, wherein the injectors are located after the screw (40), optional reaching; into the front plastisicing chamber (20), into the melt channel after the nozzle (21), into the hot runner system (23), or directly before inlet to the mould (22).
- 13) Apparatus according to claim 10 and 11 for extrusion systems, wherein the injectors are located after the extruder optional reaching; into the melt channel (10) after the cell blade pump (16), into the melt channel before the mould (22) or into the mould between outer (10) and inner (22) caliber.
- 14) Apparatus according to claim 10 and 11 die casting systems, wherein the injectors are located after the melt extruder, optional reaching into the melt channel after the dosing pump, or into the mould (22). Figure 8 and 9.
- 15) Apparatus according to claim 10 and 11 for burner systems, wherein at least one injector (11) having at least one orifice being located on a cone with an opening angle between 20° and 80° and is reaching the combustion air stream (27) for current streaming.



20) Device of an apparatus for introduction of additives into melt of plastics or metal according to claim 10 to 18, wherein the system for introduction is consisting of: a pulsing pump connected to a speed controlled motor, and said pump is for instance a crankshaft-inline-, radial-piston- and rotating-valve-version connected to the injectors; or a pump-nozzle-system (124) having a activation by a push-rod and shut-off-valve for operation to the melt (139) immediately attached to the nozzle or activation by frequency controlled solenoid, or as a high pressure pump of an airless spraying system, or as pump of steam spraying system and the said nozzle (113) of the said injector (128) is optional formed for operation mode of atomizing, pulsing and continuous introduction in flow or counterflow direction and the section of the gate of the melt channel (114) is according to the operation mode formed in reducing, continuous or expanding shape and the injector is having a Heaterband (159).

21) Device according to claim 19 for continuous operation (extruder, continuous casting systems) consisting of at least one injector (128) reaching into the melt stream (114) and pressure sensors for the melt (115), for the hydraulic circuit (106) and the medium circuit (102), wherein the hydraulic circuit and the medium circuit is attached to a high pressure pump (101, 105) with a controllable pressure limit valve and the controller for the said pressure limit valve of the media is maintaining a constant differential pressure between medium circuit and melt and hydraulic circuit and medium circuit. FIG.: 18

22) Device according to claim 19 for interrupted operation (injection moulding, die casting systems) consisting of at least one injector (128) reaching into the melt stream (114) and pressure sensors for the melt (115), for the hydraulic circuit (106) and the medium circuit (102), wherein for each circuit - the hydraulic circuit (104) and the medium circuit (105) - is connected to a pressure multiplying cylinder (143, 144) and said cylinder is connected to the said system hydraulic (142) and connected to a pressure controller and said multiplying cylinder is pressurized according to the injection cycle and the said

medium circuit and hydraulic circuit are loaded by a separate charging pump (101, 105) while the cylinders of the system hydraulic is discharged and the pressure control for the differential pressure is maintained about constant for the medium circuit (p1-p3) and for the hydraulic circuit (p2-p1). FIG.: 25

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23) Modification of a standard injector according to claim 19, having a combined supply of fuel for the hydraulic circuit and fuel for the medium circuit, wherein the fitting for the supply circuit of the said injector is replaced by a special fitting having a separate boring for hydraulic and medium supply. FIG.: 21

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24) Modification of a standard injector *having two borings in the supply circuit*) according to claim 19, having a combined supply of fuel for the hydraulic circuit and fuel for the medium circuit, wherein one boring of the said injector is blocked by a pin and the other circuit is kept open while the blocked circuit is modified by having a second fitting with boring separately. FIG.: 22

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25) Pump-nozzle-system according to claim 20, wherein the non-return valve of the medium (139) is formed as a spherical, conical or elliptical valve and the injection chamber is configured immediate to said non-return-valve and the spherical-conical valve of the supply channel (137) is having an locking spring (138) pressing the said spherical-conical valve into the valve seat located on the push rod (135) having a supply boring (132) which is connected to the medium circuit. FIG.: 23

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26) High pressure pump-nozzle-system for airless systems according to claim 20, wherein the non-return-valve of the medium (139) is formed as a spherical, conical valve and the nozzle-chamber (113) is configured immediate to the said spherical-, conical valve. FIG.: 24

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27) Method for controlling the device according to claim 19 and 20, wherein the pressure of the hydraulic circuit (106) and of the Medium circuit (102) is activated by a electrical activated pressure limit valve which is regulated by a

controller, according to the results of the pressure sensors measuring the melt pressure  $p_3$  (115) regulating the pressure  $p_2$  of the hydraulic circuit (106) above the pressure  $p_1$  of the medium circuit (102) and regulating the said pressure  $p_1$  of the medium circuit above the melt pressure  $p_3$  (115).

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28) Method for controlling the device according to claim 19 and 20, wherein the signal for the activation (108, 109, 110) of the electro-hydraulic servo-valve (112) of the injector (128) is given by a arbitrary wave form generator (120).

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29) Injection nozzle and injection valve according to claim 19 and 20, wherein the interface part (116) is formed for swiveling around the injector axis and optional adjustable for flow- and counter flow-direction injection and the shape of the nozzle is formed according to hydrodynamic laminar flow conditions. FIG.: 31 and 32

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30) Injection nozzle and injection valve according to claim 19 and 20, wherein the nozzle seat is having sharp edges (172, 173) and radial multiple orifices (167) to obtain atomizing. FIG.: 30 and 33

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31) Melt channel according to claim 19 and 20, wherein the melt channel is having variable channel sections to obtain hydraulic speed changes. FIG.: 28 and 29

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32) Method of manufacturing extruded profiles of different plastic components in systems consisting of extruder(s), mould and calibrating- and cooling line, wherein the melt stream of at least one extruder in the mould having at least two melt channels is processed by introducing additives for instance hardener, dyes, gas processors, softener, filler, reinforcement ans. into the melt stream by an injector, charging pipe, nozzle, mixing head, porous sinter metal, pump-nozzle, charging device or spraying unit regulating the pressure of the additives according to the pressure of the melt stream and advantageously introduced by pulsation and optional the volume stream of the melt stream is regulated by a

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throttle valve located at the inlet and mixing of the melt stream after the introduction of the additives by devices for instance pins, mixing shafts and labyrinth and applying shear forces according to the acceleration of the melt by variable channel sections consequently mixing the components having different properties, specific weight to the original material by configuring the melt channel in the mould having variable sections of the channel as there are expansion zones and having junctions inside the mould to unify the melt streams to one stream and subsequently creating a profile consisting of different material components melted together in the mould and passing the following calibrating and cooling section.

33) Apparatus for processing a separately diverged melt stream of an extruded mainstream according to claim 32 by means of distributor, static mixer, caliber, mandrill, wherein the devices in the melt channel are configured of at least two features, as there are:

- inlet with converging section,
- pressure sensor reaching the inlet channel, connected to a controller device for variable adjustable section as there are throttle valve, valve, sliding valve;
- injector, charging pipe, nozzle, mixing head, porous sinter metal, sliding pump, charger, atomizer reaching into the melt channel;
- after the introduction melt channel is configured with
  - pins, mixing shafts, labyrinth,
  - variable section, for instance expansion zone.

34) Apparatus for manufacturing extruded profiles of different plastic components in systems consisting of extruder(s), mould and calibrating- and cooling line, wherein the device having an arrangement to divert the melt stream of at least one extruder in the mould into at least two melt channels and having an injector, charging pipe, nozzle, mixing head, porous sinter metal, pump-nozzle, charging device or spraying unit reaching into the melt channel, for introducing additives for instance hardener, dyes, gas processors, softener, filler, reinforcement a/o. into the melt stream and having a regulator for the pressure of the additives connected to a pressure sensor located the melt stream and

advantageously having a device for pulsation and optional a throttle valve is located at the melt stream at the inlet, and having a mixer in the melt stream after the introduction of the additives, for instance pins, mixing shafts and labyrinth and having a variable channel sections for application of shear forces according to the acceleration of the melt for mixing the components having different properties, specific weight to the original material and variable sections of the channel as there are expansion zones and having junctions inside the mould to unify the melt streams to one stream and subsequently the melt channel is connected to the mould creating a profile consisting of different material components melted together in the mould and the mould is connected to the following calibrating and cooling section.

35) Apparatus according to claim 33, wherein the diversion of the melt channel, the introduction of the additives, the charging pipeline are located on a interfacing part, mounted in between the flange of the extruder and the flange of the tool.

36) Extruded plastic profile with determined section consisting of at least two components, wherein the said components are derived from at least two melt streams coming from one extruder leading to the mould in separate channels and by introducing additives to these melt streams the properties, for instance specific weight, color, hardness and structure of the matrix are different from the original properties of the extruded component.

37) Device for dosing, dotation and mixing of at least one viscous component with another viscous substance, consisting of an outer nozzle cones and an outer nozzle needle having adjustment devices for dosing or blocking of the outside flowing medium depending on the position of the nozzle needle and said nozzle needle is having a boring, wherein the outer nozzle needle is having a front chamber with the shape of a valve cone orifice or a pocket hole orifice and

the said nozzle needle with boring is having an inner nozzle needle having a conical seat for blocking and each nozzle needle having a mechanism for operating the needles respectively.

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38) Device consisting of a Hotrunner nozzle in moulds for injection moulding having a outside operated nozzle needle, wherein the said nozzle needle having a boring and having at least one orifice at the needle top and said orifice is in direction rectangular to the needle top at the needle seat and the said nozzle  
10 needle is having a connection to a common rail being connected to a high pressure pump supplying constant pressure to the nozzle needle independent to the position of the hot runner nozzle.

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39) Device according to the claim 37 and 38, wherein the nozzle needle is having a boring and having orifices, and in the said boring another nozzle needle is located blocking the said orifices according to the activating mechanism  
attached to the inner nozzle needle.

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40) Device according to claim 37 and 38, wherein the needle having the shape of a common rail injector and the said injector is attached to a mechanism for activation and the injector tip is shaped as a nozzle needle and advantageously forming the orifices to reach into the nozzle seat.

41) Device according to claim 39, wherein the gap between the outer nozzle needle and the inner nozzle needle is formed to act as a suction valve for the substances inside the inner nozzle needle.

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42) Device according to claim 37 till 41, wherein the device is attached to a subsequent located statical mixing device.

43) Device according to claim 37 to 41, wherein the device is attached to a nozzle of a plastisicing unit of a injection moulding machine.

44) Device according to claim 37 to 41, wherein the device is attached to a the melt channel of an extruder.

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